The City of Rockville identified 15 stormwater management facilities within the Rock Creek watershed for evaluation. This evaluation consisted of an assessment of the existing conditions and a determination of the best management practices (BMPs) for retrofitting each facility to improve water quality and quantity levels. The chosen facilities generally had drainage areas of 25 acres or greater.

Various types of BMPs were considered for retrofitting the existing facilities, such as stormwater management wet ponds, extended detention, shallow marshes, bioretention, micropools and wetlands. These BMPs were chosen for consideration based on the consultants' experience and available published materials on BMP efficiency, public safety, maintenance requirements, cost, and site specific criteria.

The consultants began by examining the City's files for each facility. To model the benefits offered by many of the recommended BMPs, additional information such as existing stage-storage-discharge data and structure elevations was needed. If as-built data was not available, this information was estimated from the GIS data that the consultants received from Montgomery County and from the topographic maps provided by the City of Rockville.

Each of the 15 potential retrofit sites is discussed in Section 2.1. Table 2-1 provides a summary of the existing stormwater management facilities and potential BMPs. Figure 3, located at the end of this report, presents the potential facility locations. Photographs of the existing facilities are included in Appendix A. Section 2.2 describes the selection process for choosing the four stormwater management facilities for which conceptual designs were prepared. Section 2.3 provides conceptual design details for the four selected facilities.

2.1 FIELD OBSERVATIONS AND POSSIBLE BMPS

A brief description of the field observations is presented below for each site followed by a list of possible BMPs. The most feasible BMP is listed first.

SITE 1 - BURGUNDY ESTATES – DRAINAGE AREA: 45 ACRES

The existing facility is an underground storage facility that receives runoff from a residential community. There are significant utility issues associated with the facility as well as the facility's close proximity to the stream. Very little area is available for expansion. The facility is most likely designed for water quantity, not quality, control.

Possible BMPs include:

- Sand filter
- Bioretention

SITE 2 - CROYDEN PARK – DRAINAGE AREA: 35 ACRES

The existing facility is an underground storage facility that receives runoff from business/commercial development. There is some open space behind several of the businesses. The facility is most likely designed for stormwater quantity control.

Possible BMPs include:

- Sand filter
- Bioretention

SITE 3 - DOVER ROAD NORTH – DRAINAGE AREA: 205 ACRES

The existing facility is a wet stormwater management pond that was designed for water quality control. The pond is bounded by thick woody vegetation and the dam embankment is covered with vegetation that should be removed. Due to the close proximity of businesses and two roadways, expansion of this facility would be difficult.

A second stormwater management wetland marsh with partial extended detention was added in 1998 upstream of Old Dover Road. This retrofit has maximized potential water quality and quantity controls for the drainage area to the extent practical, given space constraints and existing gaslines.

SITE 4 - MARYVALE NO. 2 – DRAINAGE AREA: 160 ACRES

The existing facility is a dry stormwater management pond that provides water quality control. The facility is located in a ball field at Maryvale Park. There are some utility issues and four to six houses that back to the ball field. The existing outfall appears to be in good condition. The open space available at the site provides the potential for significant stormwater quantity and quality control, but would severely impact the recreational uses of the site.

Possible BMPs include:

- Stormwater management wet pond
- Stormwater wetland

SITE 5 - MARYVALE NO. 1 – DRAINAGE AREA: 600 ACRES

The existing facility is a gabion checkdam along a tributary that receives flow from Maryvale No. 2 and a major storm drain system. The existing checkdam is debris-laden and in need of repair. The stream is adjacent to a community park and has steep slopes on one side. The contributing storm drain system appears to have some erosion problems.

Possible BMPs include:

- Creation of shallow marsh in overbanks
- Creation of step-pools through stream reach

- Afforestation of streambanks

SITE 6 - NORTHEAST PARK – DRAINAGE AREA: 51 ACRES

The existing facility is a dry pond located on the west side of Gude Drive opposite the Redgate Golf Course. The facility is in a wooded area adjacent to a townhouse community and receives little public use. The corrugated metal pipe outlet structure is in poor condition. The pond needs to be dredged and the downstream channel is experiencing erosion problems. The pond eventually drains to the Redgate Southeast facility (Site 13). The pond and the channel above it collect a great deal of trash, sediment and debris, and the existing pond must be frequently maintained by the City to prevent clogging.

Possible BMPs include:

- Extended detention
- Stormwater management wet pond
- Stormwater wetland

SITE 7 - MONTGOMERY COUNTY ANIMAL SHELTER – DRAINAGE AREA: < 5 ACRES

The existing facility is a small, dry stormwater management pond. The drainage area to the pond is less than five (5) acres. The existing 4-foot by 4-foot concrete riser is in good condition. There are trees and grassy vegetation adjacent to the riser and on the downstream face of the embankment that should be removed.

Possible BMPs include:

- Stormwater management wet pond
- Stormwater wetland

SITE 8 - REDGATE EAST – DRAINAGE AREA: 38 ACRES

The existing facility is a wet stormwater management pond located just off the Redgate Golf Course on the east side of Avery Road. The pond, which receives runoff from the golf course, Avery Road, and the Genesis complex, needs to be dredged. The drainage swale on the golf course that leads to the Redgate East facility has some utility issues and some minor erosion concerns that could be addressed with vegetated buffers. An existing pond on the golf course has some seepage problems; this pond drains into the drainage swale that leads to Redgate East.

Possible BMPs include:

- Deepen the stormwater wet pond
- Creation of shallow marsh in overbanks

SITE 9 - REDGATE IRRIGATION – DRAINAGE AREA: 65 ACRES

The existing facility consists of two interconnected stormwater management wet ponds. The ponds are used for irrigating the Redgate Golf Course and have numerous irrigation pipes and connector boxes around them. The pipes connecting the two ponds are submerged. The existing riser is in poor condition. The downstream outfall channel is experiencing only slight erosion problems. The water is extremely green in color in some areas, which can be attributed primarily to eutrophication from waterfowl nutrients. This pond drains into Redgate Southwest (Site No. 13).

Possible BMPs include:

- Creation of shallow marsh/enhanced vegetation in overbanks
- Bioretention facility

SITE 10 - REDGATE NORTHEAST –DRAINAGE AREA: 20 ACRES

The existing facility is a dry stormwater management pond that appears to receive runoff from Redgate Golf Course open space. The downstream face of the dam embankment is covered with trees that should be removed. The existing riser is in good condition and the pond area is mowed. The side slopes are steep, but it may be possible to excavate the area for additional storage.

Possible BMPs include:

- Stormwater management wet pond
- Creation of shallow marsh/wetland

SITE 11 - REDGATE NORTHWEST – DRAINAGE AREA: < 5 ACRES

The existing facility is a wet stormwater management pond that receives less than five (5) acres of runoff. The pond is located immediately adjacent to a golf course green. The pond drains into Redgate Irrigation (Site No. 9). Enhancements to this pond would provide minimal benefits.

Possible BMPs include:

- Creation of shallow marsh/wetland in overbanks
- Bioretention facility

SITE 12 - REDGATE SOUTHEAST – DRAINAGE AREA: 6 ACRES

The field visit revealed a small depression with a simple outlet structure. Due to the small drainage area captured and other conditions at this location, no alternative for improvement appears to be feasible.

SITE 13 - REDGATE SOUTHWEST – DRAINAGE AREA: 143 ACRES

The existing facility was designed as a dry pond, but has converted to a wetland marsh due to poor drainage. The existing riser is in poor condition and the downstream face of the dam is covered with woody vegetation. The emergency spillway is experiencing erosion problems. The pond is currently very marshy and has irrigation pipes running through it.

Possible BMPs include:

- Expand shallow marsh/wetland into overbanks
- Extended detention
- Creation of step-pools upstream of facility and excavate existing pond to provide additional storage

SITE 14 - ROCKLAND AVENUE – DRAINAGE AREA: 6 ACRES

The existing facility is an underground storage facility that receives runoff from the Rockland Commons residential area. The facility provides only water quantity control and receives runoff from approximately six (6) acres.

Possible BMPs include:

- Sand filter
- Bioretention facility

SITE 15 - TWINBROOK METRO WEST – DRAINAGE AREA: 15 ACRES

The existing facility is a dry stormwater management pond. The facility is overgrown and needs to be dredged. Sedimentation has resulted in what appears to be a shallow permanent pool of water around the outlet structure. The inlet structure is near the outlet structure. All possible BMPs include a recommended baffle system to increase the distance that inflowing stormwater travels before exiting through the outlet structure. The facility receives approximately 15 acres of runoff from the Metro facility and adjacent commercial development. This facility is owned by the Washington Metropolitan Area Transit Authority, which has maintenance responsibility.

Possible BMPs include:

- Stormwater management wet pond
- Stormwater wetland
- Shallow marsh/infiltration basin

The availability of open space to expand the size of the facilities is limited, although some can be excavated to increase storage capacity for water quantity or quality improvements. Because of the space constraints, many of the facility retrofits considered were limited to water quality enhancements. The potential for significant improvements to water quantity control was feasible only in the Redgate Subwatershed. Potential and recommended retrofit opportunities to the existing stormwater management facilities are shown in Table 2-1.

2.2 PRELIMINARY CONCEPTUAL DESIGN

The City selected four facilities for further study. The consultants performed a preliminary assessment of the facilities to provide site-specific alternatives. In a preliminary submittal, the consultants provided information and alternatives to the City for the following facilities:

- Redgate Irrigation
- Northeast Park
- Redgate Southwest
- Civic Center

After reviewing the facilities and alternatives, the City selected three projects for which the consultants would prepare conceptual designs. The City chose not to proceed with further study of the Civic Center facility. Instead, the City chose to study the possibility of a new facility at the Calvin Park site. In summary, the four projects selected for conceptual design include:

- Redgate Irrigation
- Northeast Park
- Redgate Southwest
- Calvin Park

Since the current storage and release rate approximate the desired 1-year, 24-hour extended detention control, a structural conceptual design was not prepared for the Redgate Irrigation facility; however nonstructural recommendations were prepared. The Calvin Park facility has been investigated and the desired alternative appears to be extremely costly. These conceptual designs are discussed in detail in Section 2.3.

2.3 FINAL CONCEPTUAL DESIGN

This section describes the proposed conceptual designs for the four selected sites. Detailed information including calculations, hydrologic model results and site profiles can be found in Appendix C, Conceptual Design Report, dated March 1999.

2.3.1 REDGATE IRRIGATION

The Redgate Irrigation facility is located between the 3rd and 4th holes on the Redgate Municipal Golf Course in Rockville, Maryland. Redgate Irrigation consists of two wet ponds connected by two 24-inch corrugated metal pipes. For the purposes of this study, the two connected wet ponds were treated as one facility. Approximately 64.5 acres (0.1 square mile) drains to the facility, 39 percent of which is impervious area.

The existing water control structure for the facility is a 21-inch diameter corrugated metal riser pipe. The riser is connected to a 15-inch corrugated metal outfall pipe. The existing riser structure controls at least the 2-year post- to the 2-year predevelopment peak discharges. The

emergency spillway is a 20-foot wide grassed channel and the crest of the dam embankment is El. 385.5. Water is drawn from these ponds to irrigate the golf course.

In order to maximize water quality benefits, the City, in cooperation with the Redgate Golf Course, have chosen to enhance the vegetation along the Redgate Irrigation facility banks to discourage geese. The golf course already operates under an integrated pest management plan. The City has chosen not to pursue any structural changes to the facility at this time.

The existing vegetation can also enhance water quality benefits. By designating "no mow" areas along the facility banks, or areas that would only be mowed twice a year, the vegetation will provide a better filter for pollutants in the stormwater runoff. The vegetation above the banks, in the line of sight of the golfers, will continue to be regularly mowed so as not to interfere with play.

There is no significant cost associated with the Redgate Irrigation facility conceptual design for a number of reasons, including:

- No new vegetation needs to be purchased since the existing vegetation will provide the desired water quality benefits.
- Continuation of the pest management plan and goose management measures will reduce pollutant loads and improve water quality.

The newly enhanced vegetation, in combination with the pest management plan, will provide the City and the Redgate Golf Course with some water quality improvements without altering the layout of the golf course. The existing riser is approaching the end of its useful life. The existing riser structure should be replaced with reinforced concrete, and should be designed to provide 1-year, 24-hour extended detention.

2.3.2 NORTHEAST PARK

The Northeast Park facility is a dry pond located just north of the intersection of Route 28 (Norbeck Road) and Gude Drive in Rockville, Maryland. Approximately 50.6 acres (0.08 square mile) drains to the facility, 48 percent of which is impervious area.

The existing water control structure for the facility is a 24-inch diameter corrugated metal riser pipe with a 48-inch trash rack device attached to the top of the riser. The riser is connected to a 24-inch diameter corrugated metal outfall pipe. The riser and end of the outfall pipe are badly damaged. The emergency spillway has a grassed bottom and the lowest point on the dam embankment is El. 385.5.

In order to maximize water quality benefits, the City has chosen to install a newly designed riser structure that provides 1-year, 24-hour extended detention of the stormwater runoff. The City has also chosen to include a micropool in the conceptual design to provide more detention time and sediment removal, as well as reduce the threat of clogging.

The new riser will be a five-foot by five-foot (inner dimension) concrete structure. A concrete structure is being used to provide a more durable riser structure. The riser will tie in to the existing outfall pipe. A weir will be placed in the riser for two reasons. First, the City does not want to store any more runoff than the 1-year, 24-hour volume to avoid the loss of trees from

frequent inundation. The second reason is that the facility must be able to pass the 100-year storm event with one foot of freeboard, according to regulation. The top of the riser structure will consist of a metal grate and will correspond to the maximum water surface elevation with one foot of freeboard.

A micropool will be added immediately upstream of the riser structure. The purpose of the micropool is to detain the runoff for a sufficient length of time to allow for sediment and debris removal. The micropool will be approximately four feet deep with a perimeter safety bench to allow for the growth of emergent wetland vegetation. Through periodic maintenance by City staff, the micropool can be cleaned of accumulated sediments and debris. The City will work with the Redgate Community Homeowners' Association on safety issues, such as signage at the final design stage.

The estimated construction cost for the retrofit of the Northeast Park facility is approximately $45,000. This cost estimate does not include the regrading of the emergency spillway that is discussed in the Conclusions and Recommendations section. Landscaping and planting costs are also not included in the cost estimate. A total cost estimate is included in Table 4-1.

The newly designed riser structure in combination with the proposed micropool will provide the City with the desired water quality improvements. The addition of inverted trash racks on the weirs will provide additional water quality benefits as well as easier maintenance of the trash racks themselves. The inverted pipe on the low-flow orifice will help to limit the amount of debris and sediment that reach the orifice.

The newly designed riser structure can provide the desired water quality control, the 1-year, 24-hour extended detention of the stormwater runoff. With this structure, the 100-year storm event just barely complies with the required one foot of freeboard. The City could consider widening the bottom width of the emergency spillway and grading the extremely flat (flatter than 4:1) slope to match the existing 4:1 slope. This widening would pass more flow from the emergency spillway and provide more freeboard during the larger storm events.

An upstream forebay or manufactured water quality device should be provided at the storm drain outfall into Northeast Park above this pond. This will prevent trash from the industrial park from spreading through the stream valley.

2.3.3 REDGATE SOUTHWEST

The Redgate Southwest facility is a wet pond located just north of Route 28 (Norbeck Road) in Rockville, Maryland. The facility is situated in the middle of the 16th hole on the Redgate Municipal Golf Course. The drainage area of the subbasin is 27.4 acres (0.04 square mile). Approximately 12 percent of this subbasin is impervious area. The Redgate Irrigation and Northeast Park facilities drain into Redgate Southwest; therefore the total drainage area of the facility is 142.5 acres (0.22 square mile).

The existing water control structure for the facility is a 24-inch diameter corrugated metal riser pipe. The riser pipe is severely damaged. The riser is connected to a 24-inch diameter corrugated metal outfall pipe. The facility also has an emergency spillway with a grassed bottom. The lowest point on the dam embankment is El. 352.5.

In order to maximize water quantity benefits, the City has chosen to utilize a newly designed riser structure that provides extended detention of the stormwater runoff. However, calculations showed that in order to obtain the 1-year, 24-hour extended detention storage, the water surface elevation would be approximately 2 feet above the existing top of the embankment. The golf course does not wish to significantly raise the dam. To satisfy both the golf course needs, and achieve water quantity goals, the structure will be designed to provide extended detention for the 6-month, 24-hour storm event. This alternative will require the crest of the dam embankment to be raised 1.5 feet to El. 354. The emergency spillway can remain at the existing El. 351.0.

The new riser will be a five-foot by five-foot (inner dimension) concrete structure. A concrete structure is being used to provide a more durable riser structure. The riser will tie in to the existing outfall pipe. A weir will be place in the riser for a number of reasons. First, the City does not want to store any more runoff than the 6-month, 24-hour volume because more storage would require raising the emergency spillway and the dam embankment. The second reason is that the facility must be able to pass the 100-year storm event with one foot of freeboard according to regulation. The top of the riser structure will consist of a metal grate and correspond to the maximum water surface elevation with one foot of freeboard. Another reason a weir is necessary is that the golf course does not wish to inundate more of the fairway than necessary, including the golf cart path just upstream of the facility.

The addition of inverted trash racks on the weirs will provide additional water quality benefits as well as easier maintenance of the racks themselves. The inverted pipe on the low-flow orifice will limit the amount of debris and sediment reaching the orifice. Enhancement of the wetland vegetation in the marsh area will improve water quality and the aesthetic quality of the facility. The estimated construction cost for the retrofit of the Redgate Southwest facility is approximately $39,000. This cost estimate does not include new wetland plantings for the marsh area or landscaping costs. A total cost estimate is included in Table 4-1.

2.3.4 CALVIN PARK

Calvin Park is located along Gladstone Drive north of Veirs Mill Road adjacent to the Saint Mary's and Rockville cemeteries. The drainage area to the park is approximately 89 acres, and is primarily residentially zoned property with a density of approximately 5 lots per acre. The basin discharges through a 48-inch reinforced concrete pipe into the existing stream. Calvin Park presently has a ball field and a tennis court within its confines.

Based on elevation concerns for aboveground storage space and maintenance of recreation opportunities, it was decided that underground stormwater management would be the preferred alternative at this site. The required length of 72-inch corrugated metal pipe (CMP) was calculated based on the required storage volume of for the 1-year and 2-year storm. Controlling the 1-year storm to predeveloped conditions would require approximately 6,000 linear feet of 72-inch CMP and the 2-year storm would require approximately 8,000 linear feet.

Based on recent cost information, 72-inch installed CMP and appurtenances are approximately $200 per linear foot, plus $30,000 for the control structure. Therefore, the estimated cost for controlling the 1-year storm is approximately $1.2 million, and for the 2-year storm is approximately $1.6 million. To install the multiple rows of CMP required for 1-year control, the

pipe footprint would be approximately 300 feet long by 200 feet wide. For control of the 2-year storm, the pipe footprint would be approximately 300 feet long by 250 feet wide. Unless the pipes are extended in length to be installed underneath the tennis court, there is not enough space to install sufficient underground storage for control of the 2-year storm.

It does not appear that this alternative is a cost-effective means of providing water quantity control for this tributary. In the future, if Baltimore Road is improved, the road grades could be revised to potentially provide stormwater management using the road as an embankment and excavating in the tennis court and ball field areas. There does appear to be sufficient room to provide some water quality and quantity control if maximum regrading of Calvin Park is done in this area. This grading would, however, require the removal of both the tennis court and the athletic field.